I have come across this form of the plant, having previously seen it under similar conditions of growth at Escanaba, Mich. Upham gives Minneapolis as another station for it in the state. Its range in Gray's Manual is given as "shore of Lake Ontario, and northward." As the Manual is for the United States I suppose this means the southern shore. Macoun gives it for the Canadian shore, and "the gravelly banks of rivers to lat. 69° (*Richardson.*)" The Michigan and Minnesota plants are interesting as extending the geographical range farther up the Great Lakes and into the region of the Upper Mississippi. The plant evidently conforms to the var. *intermedius* in the Manual. The conditions of growth may have something to do with the erect or semi-erect habit of the stems. In both cases where found these were carefully noted and compared with those of var. *reptans*, the common form. I have always found the latter in open places, in sand or gravel quite bare of other vegetation, or with plants low or creeping like itself, and not shading it. In the var. *intermedius* the plants grew among scattered spears of grass and rushes, considerably overtopping and shading them. It could not easily lie on the ground and root at the joints, though there is sometimes a tendency to this in the lowest joint or two. The erect or ascending stems—the latter the more common position—are so slender that they could hardly support themselves if deprived of the shelter and protection of the surrounding plants, and forced into the conditions of the creeping stemmed variety. They often lean against these plants as if too weak to stand alone, and are apparently struggling upward toward the light.

Englewood, Chicago.

A visit to the West Indies.

A. S. HITCHCOCK.

The readers of the GAZETTE may be interested in a few of the observations made during a recent trip to the West Indies.

The expedition was organized and conducted by Dr. J. T. Rothrock, of the University of Pennsylvania, in whose yacht, the White Cap, we lived during our absence from the United States. We started from Fernandina, Florida, Nov. 4th,

1890, and returned to the same port Jan. 29th, 1891. Our vessel, a yawl-rigged schooner of fifty-one tons, was commanded by Capt. Freeman Boynton, an experienced navigator in the West Indian region. The party consisted of Dr. Rothrock, D. J. Bullock and J. P. Moore, of Philadelphia, and the writer.

The month of November was spent cruising through the Bahamas of which group we visited New Providence, Eleuthera, Cat Island, Watlings, Crooked Island, Fortune Island and Great Inagua.

Excepting Inagua the islands are quite similar in geological and floral characters. Over the coral limestone are scattered thin patches of soil which have collected in the depressions, the larger and deeper of which are termed banana holes. It was surprising to see so much vegetation growing from so little soil. But the ligneous flora consists mostly of shrubs, eight or ten feet high, while trees of even moderate height are uncommon, although Andros is said to be thickly wooded.

The land owners are at present greatly interested in the cultivation of Sisal hemp,[1] the fiber of which promises to become an important production of the islands. The plant is admirably adapted to thrive on the almost soilless rock, where few other economic plants would grow. When a plantation is once established successive crops are taken from the same plants.

The pine apple[2] is cultivated more or less throughout the islands but chiefly on Eleuthera, where the peculiar red soil, which is best fitted to produce the finest fruit, is found in greater abundance. No fertilizer had been used, and the growers found that the soil, strangely enough, was wearing out, with no virgin soil to draw upon. This result will come about in time, even in a tropical country, especially where the soil is thin. But now a chemical fertilizer is imported from the United States and the land is yielding large returns.

The cocoa-nut[3] is cultivated everywhere especially near the sea-shore, where it finds the best conditions for its growth. The milk of the nut is very refreshing to a thirsty traveler. Many a time, on a hot day, when oppressed by the heat, I

[1] Agave rigida Mill. var. Sisalana Engelm. Acad. St. Louis, iii. p. 316. (For article on the industry, see Northrop, Pop. Sci. Mo. Mar. 1891.) The names following are those used in Grisebach's Flora of the British West Indies.

[2] Ananassa sativa. (Bromel.)

[3] Cocos nucifera. (Palm.)

have made my way into a plantation, found a tree where the nuts were within reach, cut one off and with my machete, slashed away a portion of the thick husk surrounding the nut, made an opening through the shell, and quaffed the cool and pleasant flavored liquid within. The green cocoa-nut contains only milk, but as it ripens the "meat" deposits around the interior, at first soft and nearly tasteless, but finally hard and sweet as in the nut of our markets. While the meat is yet soft it is much relished by some, but to me it was insipid.

At Crooked Island we saw the French wells, which are cut in the solid rock scarcely above the sea level, and some half buried cannon both of which are supposed to date back to the time of the buccaneers. Along the shores we saw innumerable piles of conch shells, each with a small hole broken in the end, where the conch had been pushed from its fastening by the fishermen. The flesh, which to me tasted like boiled leather, is much esteemed by the natives.

The southern islands of the group yield large quantities of salt. Sea-water is run into shallow ponds, each owner having his portion partitioned off by a stone wall, where it is evaporated by the sun. The residue is scraped into large heaps near by, where it is allowed to remain exposed to the sun and rain, apparently without serious loss.

Inagua differs somewhat from the other islands of the group. It is larger, more nearly circular in outline, and has a deeper covering of soil. There is a more decided change in the flora, Florida types being replaced by those of Cuba and Hayti. Grass land is comparatively abundant, affording pasturage for stock. In the interior of the island are savannas which appear to be dried up salt marshes. The experience acquired during a trip to this region will furnish our party with ample material for mosquito stories during the rest of their lives. The little pests were simply intolerable. As we walked along they flew up in clouds from the grass, biting through our clothes and even crawling up our sleeves for a good drink of our rich northern blood. No doubt the recording angel, that day, was obliged to devote considerable attention to Inagua. I tried smearing the exposed parts with oil of pennyroyal and vaseline, as has been recommended, but it was of little avail against Inagua mosquitoes. On the other hand, while in Jamaica we were not troubled by insect pests of any kind, except, in certain localities, by the ticks.

Nor were we nearly so uncomfortable from the heat, as in the Bahamas.

The trees in common cultivation through the Bahamas are poinciana,[4] with its long pendent pods and feathery foliage, which is deciduous in January; the almond,[5] easily distinguished at long distances by its flat-topped, imbricated foliage; "cedar",[6] sand-box,[7] and, of course, the cocoa-nut and banana.[8] The silk-cotton tree,[9] or "big tree" as the inhabitants have christened it, near the post office at Nassau, figured in Garden and Forest (vol. iii. p. 347), is a magnificent specimen, but is peculiar in being low and wide-spreading instead of tall and proportionately more slender as is usually the case. In Jamaica it is one of the tallest trees of the forest, sometimes rising a hundred feet to the first branch. It is used extensively for making canoes, which are hollowed out from a single log, but is of little value otherwise.

The silver-top palmetto[10] occurs abundantly throughout the Bahamas. It is used by the natives for thatching their huts; and also for making hats, mats, baskets, ropes, etc., for which purpose the central unexpanded bunch of leaves is employed.

After leaving Inagua, we sailed for Kingston, Jamaica. During our six weeks stay on this beautiful island we visited, after leaving the capital, Port Morant, Port Antonio and Lucca. The party made a most delightful trip to the summit of Blue Mountain Peak, distant from Kingston twenty-one miles. The journey to Gordantown, about half way, was made in carriages, the remainder on horseback, our provisions and apparatus being carried on pack mules. Although midwinter, flowers were abundant, as were ripe strawberries, which we picked and ate with relish. Above 5,000 feet, approximately, tree-ferns[11] appeared and gave a decided tropical look to the forest. Blue Mountain Peak reaches an altitude of about 7,300 feet, the highest point on the island. The temperature at noon was 55° F., but it is said that ice occasionally forms. From 2,000 to 4,000 feet elevation coffee and

[4] Poinciana regia. (Legum.)
[5] Terminalia Catappa. (Combret.)
[6] Casuarina equisetifolia. (Ament.)
[7] Hura crepitans. (Euphorb.)
[8] Musa sapientum. (Musac.)
[9] Eriodendron anfractuosum. (Bombac.)
[10] Thrinax argentea. (Palm.)
[11] Cyathea arborea. (Filic.)

cinchona plantations are frequently seen. We saw several more or less ruined drying-floors which were formerly used for drying the coffee. These were made by paving or cementing a square of level ground in a sunny situation.

As has been noted by most travelers in tropical regions the most striking feature of the vegetation to a person coming from the north, is the varied character of the flora. One rarely sees areas in which one species is conspicuously predominant. No one type is able to exclude others by force of numbers as in temperate climates. Another effect is the extension of the flowering season of a given species. There is to be sure, a season during which most of the flowers are produced, but one is almost sure to find stragglers in bloom at all times of the year.

Compared with the central United States, we find in Jamaica several exotic orders largely represented, as Malpighiaceae, Melastomaceae, Myrtaceae, and Piperaceae. Others of which we have but a few outlying members are there in abundance; as, Apocynaceae, Acanthaceae, Rubiaceae, Laurineae, Aroideae and the genera Solanum, Ipomoea and Croton. One cannot fail to observe also the more familiar orders Malvaceae, Leguminosae, especially Cassia and Mimosa, and a great variety of ferns. Ferns in the swamps; ferns on the arid rocks; ferns that are epiphytes; ferns that are climbing, either on trees by rootlets, or over bushes on by recurved spines; ferns of all sizes and shapes from the great tree ferns with fronds ten feet in length down to the wee species, an inch long, growing in the moss on its trunk. Aroideae will also attract attention, especially large leaved Philodendrons, climbing the tallest trees, and sending down long air-roots, which hang suspended like ropes, in fact they are used by the natives instead of ropes. The innocent looking Canna-like, but much dreaded, dumb cane[1 2] is another interesting member of the order.

Orchids are abundant, especially the epiphytic species. To see great bunches of these, many kinds in full flower, and the assortment of Tillandsias, or wild pines perched all along the branches of a half dead mango or silk-cotton tree, is a beautiful and, to the collector, usually a tantalizing sight.

On the other hand many orders, large at home, are scarcely represented in Jamaica; as, Ranunculaceae, Cruciferae, Caryophylleae, Rosaceae, Umbelliferae and the genus Carex.

[1 2] Dieffenbachia Seguine. (Aroid.)

Even composites are scarce. Of Cacteae I observed *Opuntia Tuna* common along the coast; *O. coccinellifera* and *O. Ficus-indica*, introduced around dwellings, *Melocactus communis*, in arid places; *Cereus grandiflorus* and one or two other trailing or climbing *Cerei; C. Swartzii* and *Opuntia spinosissima*. The last two species were particularly abundant on the palisades, an extremely sandy tongue of land, at the end of which is Port Royal. *O. spinosissima* sometimes grows to the height of 25 feet and is truly a tree cactus, the straight and frightfully spiny trunk being crowned by a spreading or pendent series of oblong joints. C. Swartzii (botanically so called in Jamaica) also grows to the height of 25 or 30 feet and has the habit of C. gigantea. It is used extensively for hedges, being planted very close and kept trimmed to a given height. Another hedge plant much used is the Pinguin.[13]

Euphorbia antiquorum is introduced in many places, especially in the Bahamas, and where established, often occupies considerable area to the exclusion of everything else, forming a prickly and impenetrable thicket ten or fifteen feet in height.

On Eleuthera and some of the neighboring islands grows a species of *Agave*, with the flower stalk 25 or 30 feet high. This is, curiously enough, called "bamboo" by the natives.

The real bamboo is extensively naturalized in Jamaica, and is used for a variety of purposes. Many of the huts are made by weaving the split bamboos into upright posts and thatched with "cane" (sugar cane) or wild cane.[14] Baskets and other small articles are made from the finely split culms; drinking cups and other vessels from the closed joints; fences, including the posts, are largely made from this grass.

To me one of the greatest curiosities of the flora was the mangrove[15] swamps. These have been frequently described but must be seen to be appreciated. We saw a very fine grove at Port Morant, at the head of the bay and lining each side of a small river which enters it at that point. From the outside it presented a most beautiful bank of glossy, dark-green leaves, reaching to the water's edge. Inside, however, one sees about as dismal a view as can be imagined. The trees all perched on spider legs, through whose intricacies a

[13] Bromelia Pinguin. (Bromel.)
[14] Arundo sp. (Gram.)
[15] Rhizophora Mangle. (Rhizoph.)

man could scarcely make his way ten feet, the absence of life, except the devilish looking crabs, crawling around on the roots, the stillness, and often the vile odor of rotten oysters, all combine to make a mangrove swamp, though fascinating, a place to be left as soon as possible, and I always felt, on leaving as if I were being chased by all sorts of bacterial germs. In some places land is being reclaimed from the sea quite rapidly by these swamps. The trees live only in salt water and die off as soon as the land is dry. Thus the inner edge of a swamp is composed of dead or dying trunks or loop like roots, while the outer edge is constantly pushing out into the water as soil is gradually accumulated by the roots. This extension seaward is carried on first by means of the aerial roots which either spring from the arched roots, in which case they curve outward and downward, or from the branches, when they drop nearly vertically. These frequently branch and re-branch before reaching the mud in which they become fastened.

The second method is by means of the young plantlet, whose radicle elongates considerably before dropping from the tree, so that it is all ready to start out in life as soon as released. It is 8 or 10 inches long and cigar-shaped, thus placing the center of gravity near the lower end. In this condition it is carried in the water till the lower end strikes the mud, when roots are sent down, the leaves are developed and a young mangrove is started.

Along the seashore one sees an abundance of the seaside grape,[16] named from the likeness of the clusters of fruit to our cultivated Vitis and not from habit, for it is a straggling shrub or tree with large, round, smooth and unusually red-veined leaves.

Another common plant of the lowlands and one which the collector is likely to remember with regret is the necker-bean.[17] This is a more or less climbing shrub, having the stem, petioles and even the under side of the midribs armed with recurved prickles and bearing clusters of spiny pods which contain about two drab seeds of the size of marbles. The hand is easily introduced to gather the flowers, but the withdrawal is resisted by dozens of prickles—like a patent rat-trap.

In swampy places one usually finds the familiar Job's tears[18]

[16] Cocoloba uvifera. (Polygon.)
[17] Guilandina Bonducella. (Legum.)
[18] Coix lachryma. (Gram.)

with which baskets and other ornamental articles are made. At first sight one would hardly think that the hard bean-like seeds belonged to a grass.

In the forest we saw many trees whose names were familiar. Among them was the mahogany,[19] a majestic tree with globular woody fruit and abruptly pinnate leaves; and the logwood,[20] a small, leguminous tree, bearing at that season an abundance of flowers and fruit, and extensively naturalized in Jamaica. Large quantities of its wood and also of fustic[21] are exported for extracting the dye. As it is very bulky it would seem more economical to extract the dye on the island.

The trumpet tree,[22] rather common and quite conspicuous from its large leaves whitened beneath and clustered at the ends of the long branches, is quite useful on account of the fiber obtained from the inner bark. Out of this is made a very durable cordage; also whips by peeling back the bark, cutting off the inner wood except enough for a handle, and plaiting the fiber into a lash.

In the dense woods grows the cacoon,[23] a high-climbing leguminous vine bearing an immense pod as much as three or four feet long which contains the large sea-beans often washed up by the sea on sandy beaches.

Many woody climbers in their youth entwine various trees, but these in time are strangled to death and rot away leaving the ungrateful vines as huge spirals, capable of bearing their own weight, having destroyed the ladders by which they mounted to their success.

I now mention a few of the more important fruits. Of the Anonaceæ there are the sugar apple,[24] about the size of an orange and green, the one-seeded carpids composing it being easily separated from each other; the custard apple[25] of about the same size but with the surface smooth and light brown; the sour sap,[26] larger, ovoid with the green surface weak-prickly; and the cherimoya[27] (Jeremiah, as the natives pronounce it), about the size of the foregoing, but with the

[19] Swietenia Mahogoni. (Meliac.)
[20] Haematoxylon Campechianum. (Legum.)
[21] Maclura tinctoria. (Urtic.)
[22] Cecropia peltata. (Urtic.)
[23] Entada scandens. (Legum.)
[24] Rollinia Sieberi.
[25] Anona reticulata.
[26] Anona squamosa.
[27] Anona Cherimolia.

surface smooth and faceted. This last is certainly the most delicious fruit I ever tasted. We saw it only on Blue Mountain. The sour sap is acid and at first seemed to have the flavor of kerosene, but we soon became accustomed to it and when beaten up with sugar it was quite a delicacy.

The papaw,[28] a smooth yellow fruit, of one to three or even ten pounds weight, containing the numerous shot-like seeds in the center, tastes not unlike muskmelon. The guava,[29] from which the delicious guava jelly is made, is about the size of a lime, and like the pomegranate, contains so many seeds that it is not desirable eating though pleasant flavored.

The naseberry,[30] or sapodilla as it is called in the Bahamas and to some extent in Kingston, is also about the size of a lime, but has a rough brown skin and one or two large black seeds.

The alligator pear[31] was a grievous disappointment. It is about the size of a goose egg and contains one large seed surrounded by yellow, and to us very insipid, flesh. It was learned that it should be flavored with salt, pepper, vinegar, savory, etc., when its insipidity would be overcome.

The mango,[32] in spite of its slight turpentine flavor, was very good eating, but it requires considerable experience to eat it without daubing the juice all over the face. The fruit is somewhat larger than the alligator pear and flattened. It contains a large seed, whose surface is covered with long fiber, out of which the pulp must be sucked.

Oranges, and sweet ones, too, are plenty. We bought them at fifty cents per hundred. Bananas are also abundant, but strange to say, we found great difficulty in getting ripe ones, as they are picked for shipment when green. They sell for twenty-five cents a bunch. Plantains[33] resemble bananas but can be distinguished by the longer neck to the fruit. They are eaten fried in cocoanut oil or butter, being while raw very inferior to bananas.

The akee[34] is a red, pear-shaped or slightly three-sided fruit, which contains a pulp (arillus) of the color and consist-

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[28] Carica Papaya. (Papayac.)
[29] Psidium Guava. (Myrtac.)
[30] Sapota achras. (Sapotac.)
[31] Persea gratissima. (Laurin.)
[32] Mangifera Indica. (Terebinth.)
[33] Musa paradisiaca. (Musac.)
[34] Blighia sapida. (Sapind.)

ency of beef-fat. At maturity it bursts open, exposing the large, glossy black seeds. It is used to flavor fish.

There are several starch-containing food plants which are little seen in the north. The yam[35] probably furnishes more food in Jamaica than any other plants grown. It seemed inferior to either the sweet potato or the Irish potato, being coarser and rather tasteless. The tuberous roots are large, irregular, and frequently weigh several pounds.

The cassava[36] (tapioca, mandioca) also furnishes a large amount of food to the poorer classes. The rhizomes are six or eight inches long and rather slender. The skin is peeled off, the flesh grated and mashed thoroughly with water. The residue is used to make cassava bread or cakes. The wash water is allowed to stand, when the suspended matter settles. This is used for starching clothes.

A third starch producing plant, quite common along the northern coast of Jamaica, is the coco.[37] This somewhat resembles a giant calla-lily. The rhizomes, or "coco-feet" are roasted and eaten quite commonly by the natives. The arrow-root[38] belonging to the canna family is also grown.

The bread-fruit[39] tree is cultivated, and has become naturalized in many places. The fruit, which looks like a big osage orange, is much relished by Jamaicans, but as was the case with many tropical fruits and vegetables, it seemed to us to lack flavor. Its near relative, the jack-tree[40] with much larger oblong fruit is less common.

The chocho[41] a prickly oblong vegetable resembling a cucumber, is prepared for eating in the same way as squash and tastes like it.

The ocara,[42] not uncommon in northern gardens; bayberry[43] whose leaves are often used for flavoring; allspice,[44] rose-apple,[45] a tree with leaves like the mango, but with large white flowers having numerous long stamens; tama-

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[35] Dioscorea, alata. etc. (Diosc.)
[36] Janipha Manihot. (Euphorb.)
[37] Colocasia esculenta. (Aroid.)
[38] Maranta sp. (Scitam.)
[39] Artocarpus incisa. (Urticac.)
[40] A. integrifolia.
[41] Lechium edule. (Cucurb.)
[42] Abelmoschus moschatus. (Malvac.)
[43] Pimenta acris. (Myrtac.)
[44] Pimenta vulgaris.
[45] Jambosa vulgaris. (Myrtac.)

rind,[46] whose pods contain sweet but slightly acid pulp frequently put up as preserves; pigeon-pie;[47] calabash,[48] a tree with few wide-spreading, horizontal branches and fascicled, oblanceolate leaves, the fruit of which is made into drinking vessels, etc.; the cashew,[49] whose roots taste something like peanuts; the star-apple,[50] a beautiful tree with leaves glossy, dark-green above and ferruginous silky-pubescent beneath; the bimbling[51] bearing its exceedingly sour fruit directly from the trunk; the annatto[52] (spelled also annotto, arnotto, etc.,) with prickly pods, the contents of which yields to water the red coloring matter of commerce; all these are frequent in cultivation, and were to us among the most interesting features of the island

Two other plants deserve mention. One is the sorrel[53] which we observed only in the Lucca district, where it is common. It grows to the height of three or four feet, losing its leaves in the fall. The calyx continues to grow and becomes ripe about Christmas. It is then a brilliant scarlet and quite juicy, tasting like Oxalis. The juice is extracted with hot water, flavored with spices and sweetened, thus making a very refreshing drink.

The second plant is the coco or cacao,[54] from which chocolate is made. The peculiarity of this tree is that the small flowers grow in fascicles right out of the trunk. One sees flowers and all stages of fruit on the same tree. The latter when ripe is a dark red in color, ovoid, six or eight inches long, with ten longitudinal furrows. The seeds are washed free from pulp, carefully dried, and (when made by the natives on a small scale) pounded into coarse powder between stones. To this is added cocoanut oil and enough annatto to color it, when it is formed into cylinders about the size of a candle and six or eight inches long. The cocoanut oil is prepared by grating up the ripe nut, usually very laboriously by the use of an ordinary tin grater, boiling the meal with water and skimming the oil off. A little annatto is usually added to give it a yellow color.

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[46] Tamarindus Indica. (Legum.)
[47] Cajanus Indicus. (Legum.)
[48] Crescentia Cujete. Bignon.)
[49] Anacardium occidentale. (Terebinth.)
[50] Chrysophyllum Cainito. (Sapot.)
[51] Averrhoa Bilimbi. (Oxalid.)
[52] Bixa orellana. (Bixin.)
[53] Hibiscus Sabdarifa. (Malvac.)
[54] Theobroma cacao. (Buettner.)

On our way home from Jamaica we stopped for three days at Grand Cayman. This is a small coral island midway between Jamaica and the west end of Cuba, and a dependency of the former. The inhabitants are mostly white, very hospitable, and differ from those of the other islands visited in being active, thrifty and enterprising. Here we saw the walnut,[55] whose fruit resembles our black walnut in taste, shape and in being enclosed in a rather woody shuck.

Another interesting tree which we did not see in Jamaica, was the manchioneal.[56] The inhabitants told great stories about its deadly effects and warned me against it. To test the matter I rubbed some of the fresh juice on the back of my hand, allowing it to remain three hours, without result. This only proves that the plant does not always have the effect ascribed to it. But it seems to be a fact, from the common report, that the juice will frequently form bad sores where it touches the skin. As is the case with our poison ivy, it probably depends upon circumstances and the individual.

During the trip I made collections of seeds, living plants and herbarium specimens which are being studied at the Garden. There are many difficulties in the way of collecting dried plants in the tropics. One of the worst is the humidity of the atmosphere. I succeeded in avoiding all trouble from mould by using drying paper (best quality carpet paper) which had been previously impregnated with corrosive sublimate. I used wire presses, with straps, changed the papers at least twice a day, and frequently exposed the already dried bundles to the sun.

Missouri Botanical Garden, St. Louis.

Notes on the apical growth of Liverworts.

DAVID M. MOTTIER.

(WITH PLATE XIII.)

The striking similarity between the very young thallus of certain liverworts and fern prothallia is a familiar fact to botanists and has led me to suspect that a careful study of the apical growth of several available forms, by more accurate

[55] Aleurites triloba. (Euphorb.)
[56] Hippomane mancinella (Euphorb.)